

PRELIMINARY INVESTIGATION INTO THE
STRIDULATION MECHANISMS OF THE GENUS *ELAPHRUS*
(COLEOPTERA: CARABIDAE): *ELAPHRUS*
CUPREUS DUFTSCHMID.

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ABSTRACT

Stridulation in *Elaphrus cupreus* is audible. Sound production is brought about by movement of the plectron apparatus of the abdominal projection against that of the elytra. Alary-elytral stridulatory apparatus does not appear to be a mechanism of stridulation in *E. cupreus*.

Elaphrus cupreus occurs throughout the British Isles at the margins of most kinds of standing water, where some vegetative cover is present. These beetles are most frequently found running in the sunshine from April through July. Stridulation occurs when an individual is disturbed; this sound can be heard quite easily up to 2 feet away.

MECHANISM OF SOUND PRODUCTION

When individual beetles are stimulated mechanically they stridulate. Microscope observations indicate that sound production is associated with extension and retraction of abdominal segments.

The outer edges of mobile abdominal segments form a ridge or projection which sits in and rubs against a longitudinal flange on the inside of the lateral edge of the elytron (figs. 1, 2). This flange is enlarged and forms a longitudinal epipleural groove along the edge of the elytron. The elytra are not fused as in the carabid *Cychnus caraboides* (Linné) (see Claridge 1974), and all individuals are fully winged.

Scanning electron micrographs were used to determine the actual site of the stridulation mechanism on both the abdominal projection and the epipleural groove. Having done this, posterior edges of the elytra, corresponding to the area thought to cause stridulation, were removed from individuals known to stridulate. Sound emission was terminated by this treatment even though individuals performed abdominal stridulatory movements.

The micrographs revealed a surface structure similar to that found in *Cychnus caraboides* (see Claridge 1974). The inner face of the epipleural groove is covered with a regular arrangement of plectron-like projections (fig. 3). Opposite and opposing this is a similar set of plectron-like projections on the outer edge of the abdominal projection (fig. 4). Both plectron-like structures are rigid, heavily sclerotised, and face forward at approximately 35 degrees to the horizontal. During stridulation these plectron-like structures are brought together and flick against each other to emit sound.

In anaesthetised beetles no distinct sound resembling normal stridula-

tion could be produced by manual extension and retraction of the abdomen against the elytra; however in certain positions the sensation of 2 abrasive surfaces being rubbed together could be felt through the finger-tips.

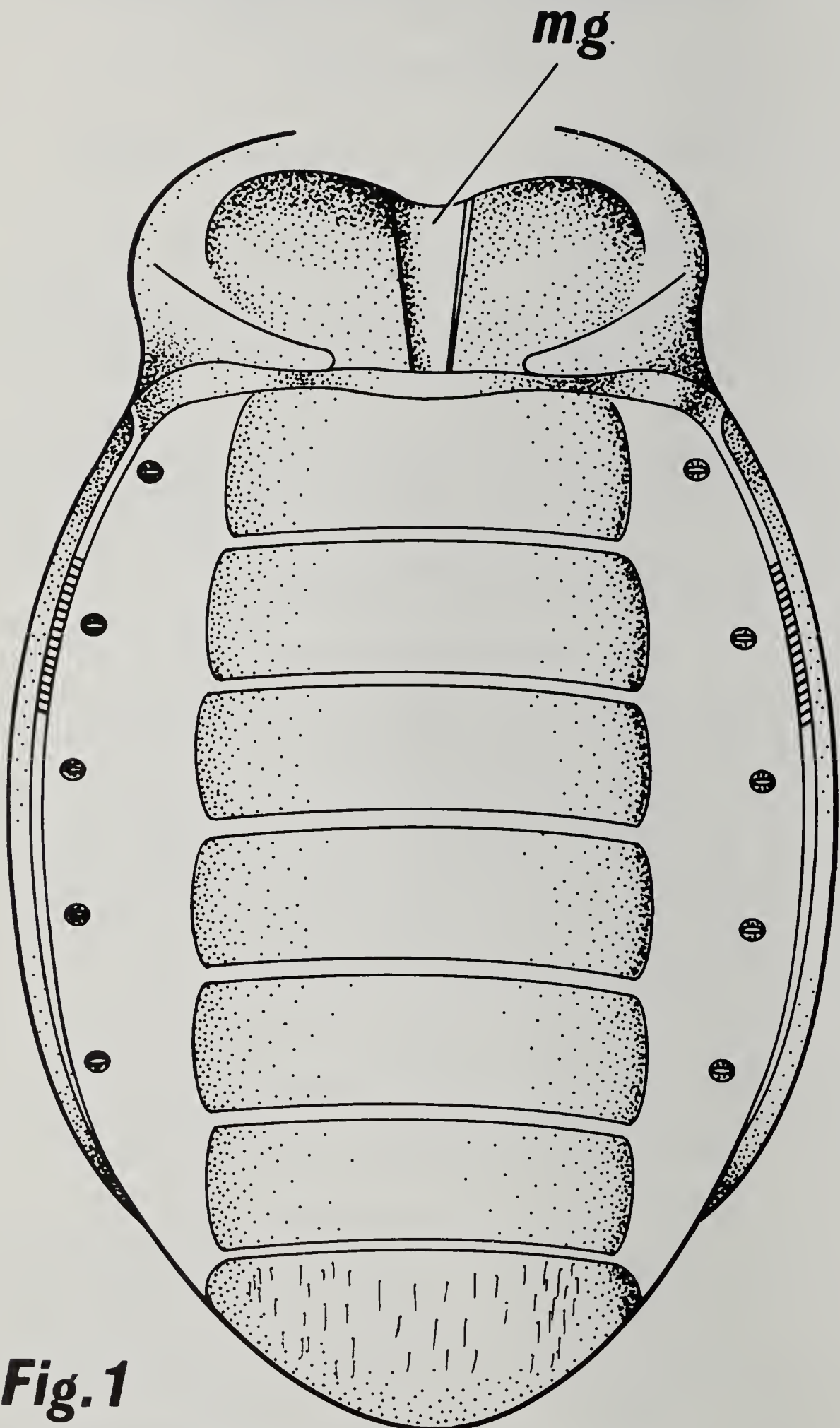


Fig. 1

Fig. 1. Abdominal dorsal aspect, somewhat diagrammatic, of *Elaphrus cupreus* (L.).

SUPPLEMENT

Landois (see Gahan 1900) described the stridulation structures in the genus *Elaphrus* as "a series of very short ridges on the abdomen placed in a slightly arcuate row on each side of the penultimate dorsal segment, and a series of longitudinal striae lying on the posterior expanded part of the epipleural ridge which runs along the underside of each elytron". Bauer (1973) also discussed these supposed stridulation structures.

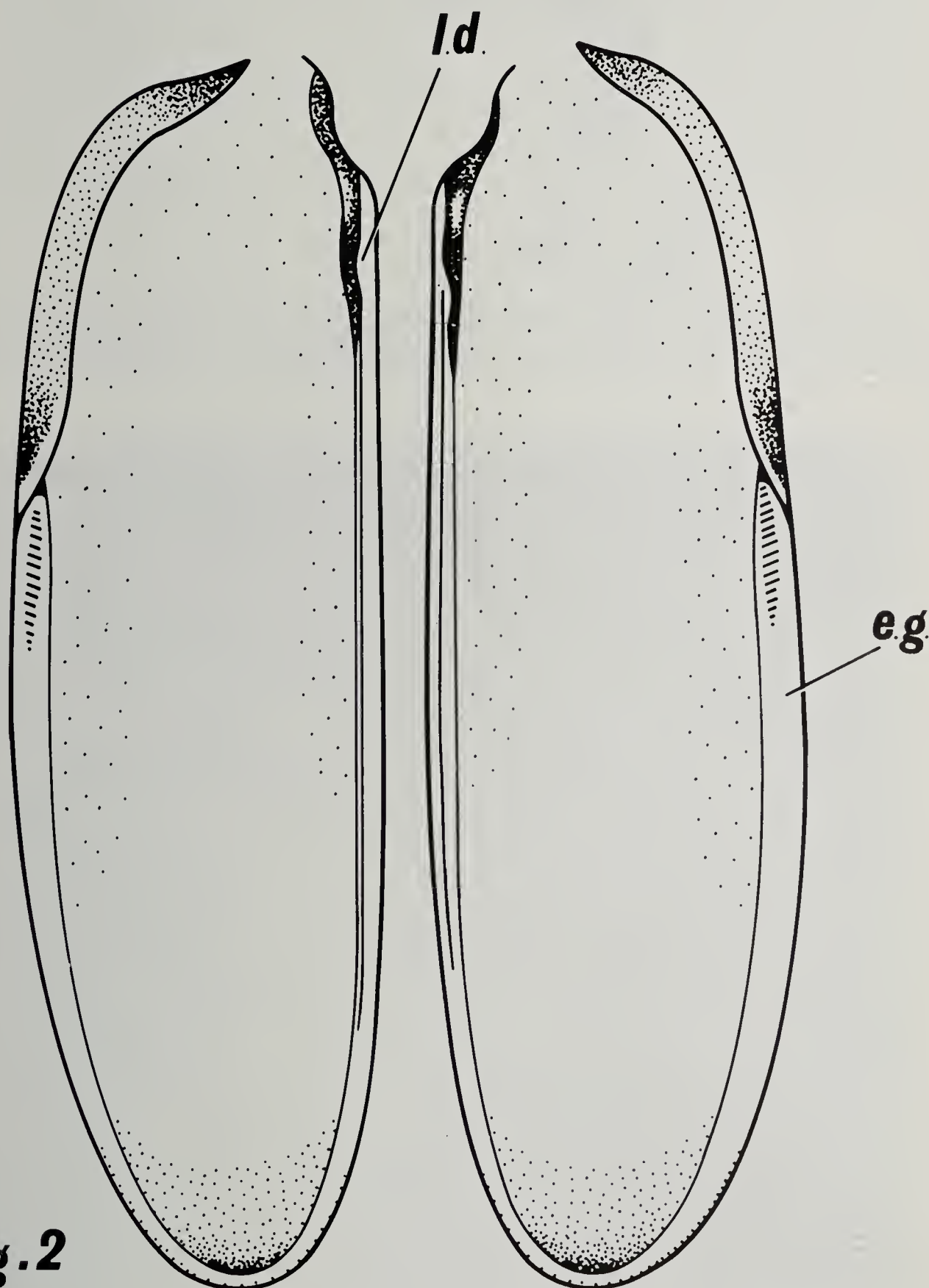


Fig. 2

Fig. 2. Elytral stridulatory surface (cross hatched) in epipleural groove (e.g.) and locking device (l.d.), ventral aspect, somewhat diagrammatic, of *Elaphrus cupreus* (L.)



Fig. 2a

Fig. 2a. Elytral (upper) and abdominal (lower) stridulatory surface (cross hatched) in x-section, somewhat diagrammatic, of *Elaphrus cupreus* (L.).

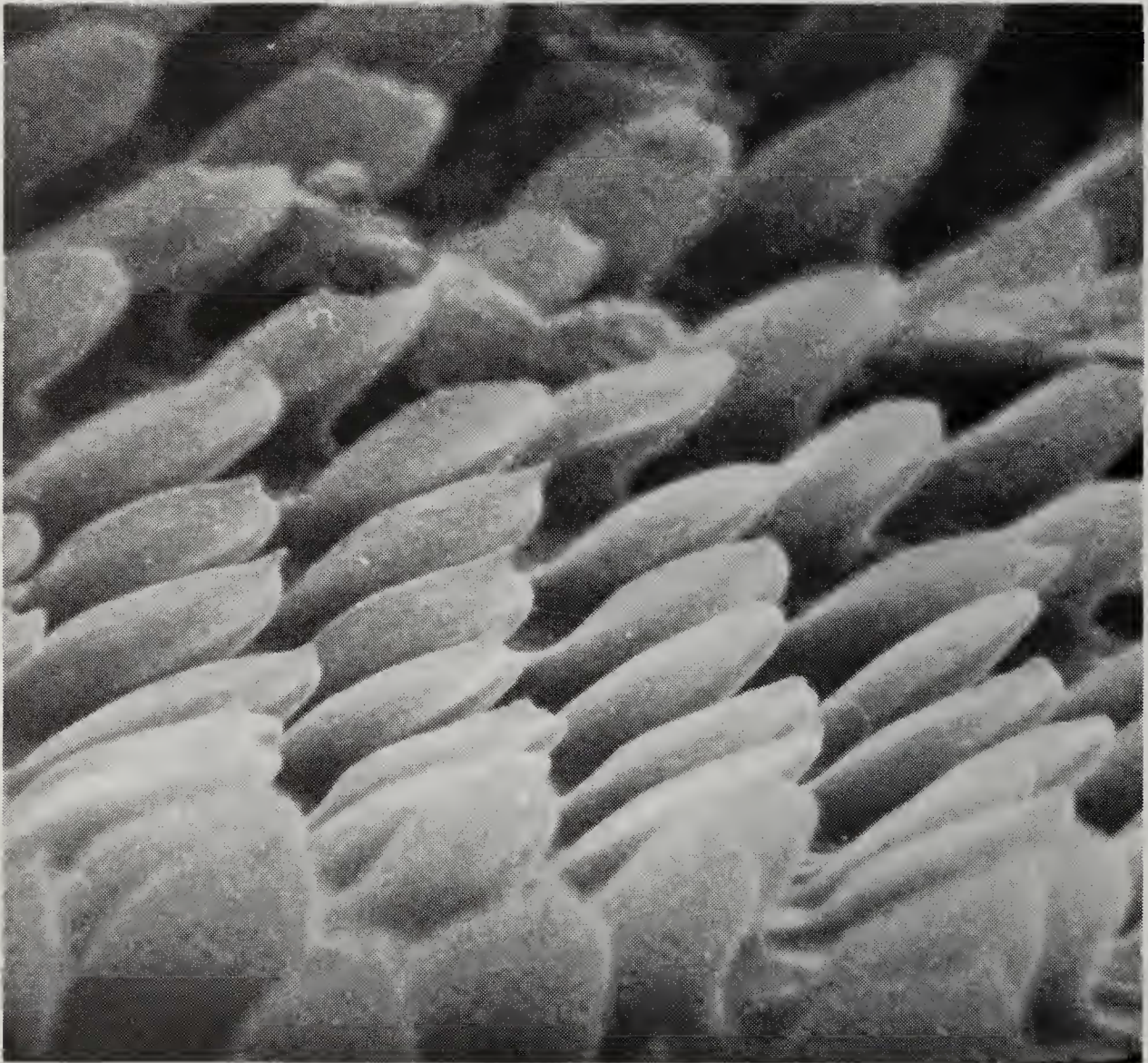


Fig. 3. Elytral stridulatory surface of epipleural groove of *Elaphrus cupreus* (L.), 5200X.

The micrographs revealed both of these structures. Specimens of *E. cupreus* were anaesthetised and the part corresponding to the longitudinal striae of each elytron removed exposing the penultimate dorsal segment. After the beetles were allowed to recover, mechanical stimulation induced stridulation. Therefore, it appears that the abdominal-elytral mechanism described for the genus *Elaphrus* by Landois, and also by Bauer (1973), is not the apparatus concerned with stridulation in *E. cupreus*.

Specimens preserved in 70 percent alcohol, 5 percent glycerol were microscopically examined for a file, or *pars stridens*, on the dorsal side of the costal vein of the wing (see Freitag and Lee 1972). Observations proved positive. Specimens of *E. cupreus*, known to stridulate, were then anaesthetised, and the *pars stridens* of each wing was removed and the beetle allowed to recover. Normal stridulation could be induced in these specimens when stimulated mechanically, indicating that an alary-elytral stridulatory apparatus is not the mechanism for stridulation in *E. cupreus*.

MECHANISM FOR LOCKING THE ELYTRA

To lock the elytra together there is a device similar to that reported by Claridge (1968) in the weevil *Rhynchaenus fagi* (Linné). This locking device holds the elytra firmly over the abdomen.

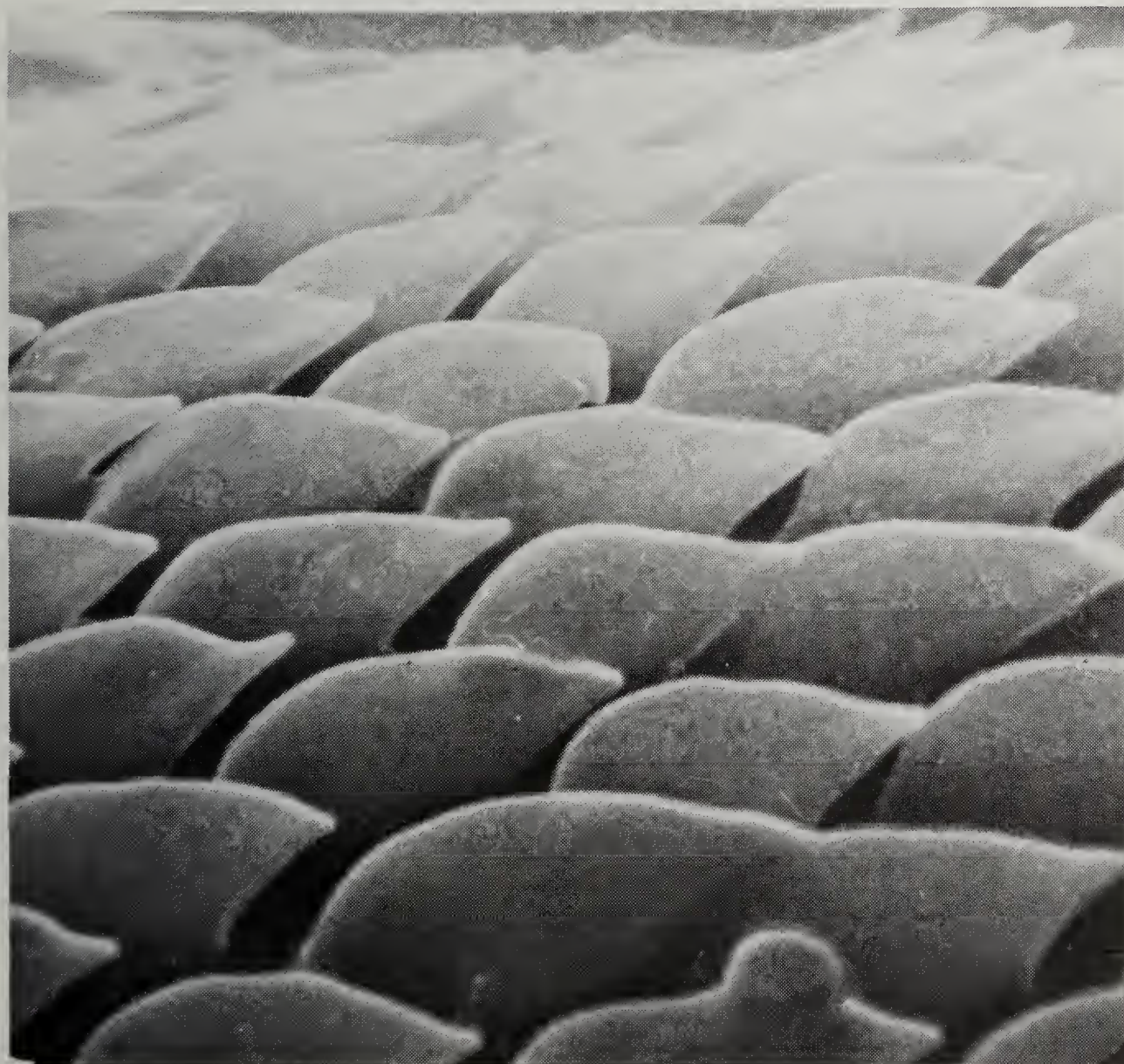


Fig. 4. Abdominal stridulatory surface of right projection of *Elaphrus cupreus* (L.), 5800X.

Towards the base of each elytron the median edge is thickened. On the thickened edge of the right elytron is a knob which fits into a depression in the thickened edge of the left elytron (fig. 2). The elytra are thus held together and fit into a groove on the metanotum (fig. 1), in the manner of a 'press stud' (Claridge 1968).

DISCUSSION

Sound production in *Elaphrus cupreus* is probably brought about by a combination of 2 mechanisms. The locking of the elytra holds each elytron in place and may help with the resonating and amplifying effects, and the movement of the plectron apparatus of the abdominal projection against that of the elytra emits sound. The alary-elytral type of stridulatory apparatus does not appear to be the mechanism of stridulation in this particular species.

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